



June 20, 1986

Dr. Hildegarde Howard
2045 Q Via Mariposa East
Laguna Hills, California

Dear Hildegarde:

I have received your manuscript, entitled "Middle Miocene Birds from the Foothills of the Santa Ana Mountains, Orange County, California", submitted for consideration for Contributions in Science. It consists of 21 pages and one illustration.

marine

#382

Thank you for your interest in our publishing program.

Sincerely,

Lawrence G. Barnes
Section Head Vertebrate Paleontology

LGB:lv

Craig C. Black, *Director*
Leon G. Arnold, *Assistant Director*

NATURAL HISTORY MUSEUM LOS ANGELES COUNTY

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ABSTRACT.

A marine vertebrate assemblage of Middle Miocene age has been recovered from the foothills of the Santa Ana Mountains in Orange County, California. Several localities on both sides of Oso Creek ^{have} produced ^{the} fossils. Among these fossils, 54 avian bones represent Diomedea ^e ?milleri (albatross), Puffinus priscus, Puffinus [#] ?n.sp., Puffinus spp. (shearwaters), Sulidae (boobies and gannets, 2 species), Anatidae (undescribed large diving duck), and Alcodes ?ulnulus (flightless auk). These comprise the oldest fossil avifauna yet described in the Orange County area, and the only ones of Middle Miocene age from south of the outcrops of the Sharktooth Hill Bonebed in Kern County. ^{The} Closest affinities ^{of this assemblage} are with birds from the Sharktooth Hill Bonebed, ^{which is} ^{California} of the same age ^{elsewhere} in Kern County, California. The ^{primitive} early flightless auk, Alcodes, is known, however, ^{only} ~~only~~ from slightly younger strata in the Monterey Formation in Laguna Hills, Orange County.

INTRODUCTION

From 1978 to 1983 the Natural History Museum of Los Angeles County collected fossils in Middle Miocene marine sediments exposed in the foothills of the Santa Ana Mountains in the north part of Mission Viejo, Orange County, California (Raschke, 1984). The material was exposed during the grading of hills on both sides of Oso Creek during construction of an earth-fill dam, named later Upper Oso Dam. The subjects of the present study are the 54 bird bones, representing 34 individuals. These are from LACM localities 4545, 4546, and 4547, in descending order of stratification, in coarse sand deposits ^{which} underlie shales and siltstones referred to the Late Miocene Puente and Monterey Formations in this area, ^{which} ~~and~~ have been referred to the Topanga Formation (Morton, et al, 1973). (The Topanga Formation, in its type area in the Santa Monica Mountains, many miles to the north within the Los Angeles Basin, has been upgraded to the status of a group (Yerkes et al, 1979) and the name ^{as a formation} ~~is~~ is probably no longer applicable in Orange County.) The sediments are older than those of the bird-bearing Monterey Formation that have been previously reported (Howard 1966, 1968, 1976, 1978) from horizons in Laguna Hills (Leisure World) and Laguna Niguel, several miles to the southwest in Orange County, and are roughly comparable in age to the Sharktooth Hill ^{local} ~~local~~ fauna in the Middle Miocene Round Mountain Silt to the north, in Kern County. Fossil avian species have been described from the Sharktooth Hill Bonebed by Wetmore (1930), Miller (1961, 1962), Howard (1966, 1984), and Warter (1976). ^{That deposit is correlated with the Barstovian North American Land Mammal Age, and is approximately 14 to 15 million years old (Barnes, 1977).} Unfortunately, many of the bones from Orange County described here are not only fragmented, but crushed and distorted. Specific identification has, therefore, been difficult. Five families are recognized, with most abundant representation ^{among} ~~of~~ the shearwaters, Family Procellariidae (26 bones, 19 individuals), and the booby-gannet family, Sulidae (22 bones, 10 individuals).

Others are of the albatross family, Diomedidae (2 bones of 1 individual), waterfowl family, Anatidae (1 bone) and auk family, Alcidae (3 bones of 3 individuals). At least eight species are represented.

Both the families Procellariidae and Sulidae are well represented in the fossil record, and seven species of Sulidae and eight species of Procellariidae (including 2 fulmars) have been ^{previously} described from California's Miocene deposits. A thorough study of each of these families is, therefore, in order. The Sulidae are now in process of being reviewed by Kenneth I. Warheit of the Department of Paleontology at the University of California, Berkeley. Assignments herein of the shearwater and booby-gannet material should be considered tentative.

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METHODS AND MATERIALS

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Acronyms used for institutions are:

CAS - California Academy of Sciences, San Francisco, *California.*

LACM - Natural History Museum of Los Angeles County, Los Angeles, *California.*

UCLA - University of California at Los Angeles, California *⑥*

UCMP - University of California, */* Museum of Paleontology, Berkeley,
California *⑥*

UCMVZ - University of California, */* Museum of Vertebrate Zoology,
Berkeley, California *⑥*

USNM - United States National Museum of Natural History, Washington,
D.C.

In addition to the fossil material in the LACM collections, referred material and casts of types from CAS, UCMP, UCLA and USNM have been available for this study. Modern skeletal material is from the LACM collections, with the exception of specimens of Aethia from UCMVZ. *←*

← The locality number LACM 4464 is applied to material found as float from LACM localities 4545, 4546, and 4547, but of no precise provenience. *←*

← Classification follows that of the 1983 edition of the American Ornithologists' Union Checklist of North American Birds.

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SYSTEMATICS

ORDER PROCELLARIIFORMES

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Family Diomedidae -- Albatrosses

Genus Diomedea Linnaeus, 1758Diomedea ?milleri Howard, 1966*1 species*

MATERIAL. Associated proximal half of right ulna and distal end and shaft fragments of radius, LACM 120439, from LACM locality 4547.

DISCUSSION. Albatross bones have been previously reported from several Miocene age sites in California, but only two species, both from the Sharktooth Hill Bonebed, have been described: Diomedea californica Miller, 1962 and D. milleri Howard, 1966. The holotype of D. californica is a tarsometatarsus, slightly larger than that of the modern albatross, D. albatrus, but not as large as that of D. exulans. D. milleri ^{is} ~~was~~ of markedly smaller size.

The holotype of D. milleri is a proximal end of an ulna with a proximal breadth of 14.4 mm, as compared to 17.6 mm for that of the living D. nigripes (see Howard, 1966:4). The ulna, LACM 120439, from the Upper Oso Dam site measures 15.8 mm. The associated radius is also narrower of shaft than ~~in~~ ^{that of} D. nigripes. The area immediately distal to the ulnar cotylae, which contains the diagnostic characters of the species D. milleri, is crushed in LACM 120439. However, a clearly defined ridge on the palmar side of the shaft below this area suggests that there was a distinct angle between the palmar and internal surfaces of the shaft immediately below the internal cotyla as described for D. milleri. Although LACM 120439 appears to have a more prominent acromion and external cotyla than in the holotype of D. milleri, these areas are slightly eroded in the latter.

Family Procellariidae -- Shearwaters

Genus Puffinus Brisson, 1760

Puffinus priscus Miller, 1961

L. space

REFERRED MATERIAL. Left humerus, LACM 120415; associated right and left humeri and incomplete right ulna, LACM 120416; distal end of right humerus, LACM 120417; proximal fragment of left ulna, LACM 120424; all from locality LACM 4546. Proximal three-fourths of right humerus, LACM 126159, from locality 4464.

TENTATIVELY REFERRED MATERIAL. Right and left distal ends of tibiotarsi, LACM 120425 (right) and 120426 (left); right tarsometatarsus lacking proximal end, LACM 120419; all from locality 4546.

DISCUSSION. The humeri agree in general conformation, size and flatness of shaft with the holotype distal end of this element from the Sharktooth Hill Bonebed and/or additional unpublished specimens (three of which - LACM 18140, LACM 44556 and LACM 126219 - are complete) from the same ^{Bonebed} locality, now referred to Puffinus priscus. Measurements of ^{the Upper} Oso Dam humeri are: length 79.3-81.2 mm, breadth distal condyles 7.4-7.7 mm, distance from distal surface of condyles to proximal surface of ectepicondylar prominence 9.5-9.9 mm. The same measurements ^{from the} in Sharktooth Hill ^{Bonebed} (humeri) assigned to P. priscus are: length 80.3-82.5 mm, breadth distal condyles 7.1-7.7 mm (holotype 7.5 mm), and distance from distal condyles to proximal surface of ectepicondylar prominence 8.9-10.0 mm (holotype 9.5 mm).

The two ulnae, one of which is associated with humeri LACM 120416, have a high, pointed olecranon (possibly exaggerated by crushing in this area) and long, pointed and upturned external cotyla. These characters are suggestive of those of modern P. opisthomelas, though to an exaggerated degree.

The tarsometatarsus, which measures 6.1 mm in distal breadth, is tentatively assigned to P. priscus on the basis of favorable comparison with tarsometatarsi from ^{the} Sharktooth Hill ^{Bonebed}. Of the three Puffinus tarsometatarsi now available from the latter locality, one incomplete distal half (LACM 104058), which agrees in size with LACM 120419 from Orange County, is slightly smaller than the other two,

and I believe is assignable to P. priscus.

The tibiotarsi resemble the only distal end of this element that has been found ^{in the} ~~at~~ Sharktooth Hill ^{Bonebed} LACM 122994, a specimen which is tentatively referred to P. priscus on the basis of its size relative to that of the tarsometatarsi noted above.

Puffinus sp., possibly undescribed

REFERRED MATERIAL. Associated, complete, but poorly preserved, right humerus, crushed proximal end of ulna and proximal and distal fragments of radius, LACM 120422, from locality LACM 4546; ^{space} ~~collected~~ 23 April ^{space} 1980 by L. G. Barnes.

DESCRIPTION. The humerus is notably distinguishable from the holotype of P. priscus Miller, 1961 (UCMP 58185), but less so from the holotype of P. mitchelli Miller, 1961 (UCMP 58184) (casts of which are at hand) in having a more rounded, less flattened shaft. In length, it is intermediate between specimens from ^{the} Sharktooth Hill ^{Bonebed} referred to these species; LACM 120422, 90.4 mm; Sharktooth Hill P. priscus specimens 80.2–82.5 mm, one measureable specimen of P. mitchelli (LACM 17500) 98.1 mm. The ulna is severely crushed and measures only 7.0 mm across the cotylae. The olecranon is crushed to a point.

DISCUSSION. Poor preservation of the Upper Oso Dam humerus makes difficult any detailed comparison with P. inceptor Wetmore, 1930. A cast of the holotype distal end of humerus of P. inceptor (CAS 5223) is available. The ^{Upper} Oso Dam specimen is broken through the internal ^{condyle} ~~trochlea~~, but appears to lack the notable internal thrust of the distal end which is characteristic of P. inceptor, and is reflected in the measurements given by Wetmore (1930:87): breadth of shaft 5.9 mm, greatest distal breadth 12.2 mm. In the ^{Upper} Oso Dam humerus, the shaft breadth is 6.3 mm, distal breadth 11.2 mm.

Other Miocene members of the genus Puffinus recorded from California include P. diatomicus Miller, 1925 from the Late Miocene Sisquoc Formation in Santa Barbara County, in which the humerus is included in the holotype and referred

skeletal impressions. Miller recorded the length of these humeri as 80–84 mm (considerably smaller than LACM 120422). The humerus is ^{also} the holotype of the two ^{previously} ^{named} Late Miocene Orange County species, P. calhouni Howard, 1968 and P. barnesi Howard, 1978. Both are smaller and have a more compressed shaft than ^{does} ~~in~~ LACM 120422. Compared with the holotype distal end of the Early Miocene P. micraulax Brodkorb, 1963 from Florida, LACM 120422 is broader. The holotype distal end of humerus of P. conradi March, 1970, from the Middle Miocene Calvert Formation of Maryland, is broader and has a heavier shaft.

The poor condition of LACM 120422 precludes naming a species with this material as ^{the} holotype. Should more specimens assignable to this shearwater become available, ^{comparisons} ~~studies~~ should also be made of the French Middle Miocene species, P. aquitanicus (Milne-Edwards, 1874), P. antiquus (Milne-Edwards, 1874) and P. arvernensis Milne-Edwards, 1971, redescribed by Shufeldt, 1896. In fact, Olson (1985:211) has noted the need for a world-wide revision of fossils assigned to the genus Puffinus. e

add additional space

Puffinus spp. *space*

REFERRED MATERIAL. Complete right ulna, LACM 120420; distal 3/4 left ulna, LACM 124360; proximal and distal ends of right ulna ^(u) LACM 120421; fragment of proximal end of left ulna, LACM 126155; associated fragments of distal end of ulna and proximal end of radius and carpmetacarpus, LACM 126156; complete radius, LACM 120423; right caropmetacarpus, LACM 120419; associated fragments of distal end of left ulna and tarsometatarsal shaft, LACM 126157; all from locality LACM 4546. Distal fragment of radius, LACM 120412; incomplete right humerus, LACM 126160 ^{both} from locality LACM 4464.

DISCUSSION. Size alone suggests that at least two species are represented by this material. Most of the specimens [?] are of the small size suggestive of P. priscus. One poorly preserved humerus (LACM 126160) and one ulna (LACM 120420) are, however, notably larger. The humerus has been partly restored, but appears

to have a more flattened shaft toward the distal half of the bone than do humeri of P. mitchelli from ^{the} Sharktooth Hill ^{Bonebed}. The length of this poorly preserved humerus, from proximal edge of brachial impression to head is 83.2 mm. The same measurement of a Sharktooth Hill humerus, LACM 17500, referred to P. mitchelli, is 86.6 mm. The ulna, LACM 120420, has a length of 95.7 mm. By contrast, the longest ulna known from the Sharktooth Hill Bonebed (LACM 124359) measures only 88.2 mm. Both are markedly larger than the incomplete Upper Oso Dam ulna (LACM 120416) which is associated with the humerus assigned herein to P. priscus.

ORDER PELECANIFORMES

Famile Sulidae -- Boobies and Gannets

Sulidae, spp. ^{↳ para}

REFERRED MATERIAL. Associated right and left humeri, ulnae, and badly crushed radius, LACM 120433; associated left coracoid and proximal fragment of shaft of left humerus, LACM 120428; right tarsometatarsus lacking part of proximal end, LACM 120432; proximal end of radius, LACM 120429; proximal end of humerus, LACM 120430; distal end of humerus, LACM 120431; skull fragment, LACM 120427 ⁵ all from locality 4546. Associated incomplete radius and ulna, LACM 120438; humerus, LACM 123910; [associated [seven] incomplete and poorly preserved bones lying together in matrix with the following elements represented: incomplete mandible, proximal end of right humerus, three fragments of left humerus, fragment of left ulna, distal end of right radius, proximal end of left radius overlying left carpometacarpus, LACM 126161 ² all from locality LACM 4547.

DISCUSSION. This material will be included in Warheit's study of the family Sulidae. In my brief examination of the material from Upper Oso Dam, I noted two humeri (LACM 120433, 120431) which exceed in measurements specimens of Morus vagabundus Wetmore, 1930, the only sulid species described from the Sharktooth Hill Bonebed. The distal breadth of the holotype of M. vagabundus is 18.3 mm;

the same measurement in LACM 120431 is 21.0 mm; length of referred humerus of M. vagabundus, 170 mm (Howard 1966:6), length of LACM 120433, 183 mm. On the other hand, the Upper Oso Dam specimens, LACM 120428, 120432, and 120438, though difficult to measure exactly, suggest a smaller species.

✓ That more than one species of solid occurs in the Sharktooth Hill Bonebed was noted by Miller (1961:401), who reported a proximal fragment of ulna of larger size than the one referred ^{to} by M. vagabundus by Wetmore (1930). Also, Howard (1966:7) recorded two tarsometatarsi which differ in qualitative characters as well as in size.

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ORDER ANSERIFORMES

Family Anatidae -- Ducks, Geese and Swans

Subfamily Anatinae -- Ducks

Tribe Mergini -- Divers

space

REFERRED SPECIMEN. Distal end of left femur, LACM 125994, from locality LACM 4546, collected by Museum field party, 1981.

DESCRIPTION. The fibular condyle is thrust laterally, and there is a deep angular depression above the condyles, posteriorly, as in diving ducks such as those of the genera Somateria, Mergus and Melanitta, but the specimen is markedly larger than in living species of these genera. The breadth of the distal end is 20.7 mm.

DISCUSSION. This femur represents a large diving anatid, goose-like in size, and in general conformation suggestive of undescribed specimens of femora from the Sharktooth Hill Bonebed. It is, however, more slender, and the muscle scar on the internal side of the posterior face is more proximally placed. Anteriorly the intercotylar area appears to be more deeply excavated, but allowance must be made for the poor preservation of the specimen.

The femora and other related elements of the skeleton from the Sharktooth Hill Bonebed are still under study. It is anticipated that a new species, and

(Howard, in preparation)

probably a new genus, will be proposed. The single femur from Upper Oso Dam indicates the presence of a large diving anatinid in the Orange County area at the same time as the existence of such a bird--probably congeneric, but specifically distinct--in the Kern County area.

ORDER CHARADRIIFORMES Lead space

Family Alcidae -- Auks et al

Genus Alcodes Howard, 1968

Alcodes ?ulnulus Howard, 1968 Lspace

MATERIAL. Left ulna, LACM 120434, from locality LACM 4546; left humerus, LACM 120414, from locality LACM 4545; right coracoid, LACM 121010, from locality LACM 4547.

DESCRIPTION. The holotype of Alcodes ulnulus is a complete left ulna (LACM 18277), ^{and} with a distal end of a right ulna (LACM 18279) and the proximal end of ^a right carpometacarpus (LACM 18278) ^{are} referred to the species (Howard, 1968). An incomplete proximal portion of ^a right ulna (LACM 18280), ten percent larger than the holotype, was tentatively referred in the same publication.

The ulna from Upper Oso Dam is not as well preserved as the holotype, but resembles it by having a relatively heavy shaft for such a short bone. It is, however, slightly longer, and relatively narrower than the holotype. In contrast, the ulna from a Recent specimen of the Least Auklet, Aethia pusilla (UCMVZ 60629), is longer and narrower, and that of the Pliocene flightless auk-like swimmer, Mancalla milleri Howard, 1966, is shorter and broader. Although Alcodes had evolved in the direction of flightlessness, it is clearly not as ^{derived} ~~far advanced~~ as Mancalla.

The humerus, LACM 120414, though incomplete, resembles the paratype specimen of the Pliocene Mancalla milleri Howard, 1970, (LACM 2813) in the compression of the distal end and ⁱⁿ the height of its ectepicondylar prominence. The deltoid crest, however, is not as extensive as in M. milleri, and the shaft is narrower

throughout. Other distinctive characters, peculiar to the Upper Oso Dam specimen are: proximally the pectoral attachment and external tuberosity are distinctly external to the capital shaft ridge, ^{and} separated from the ridge by a depression, and the ridge is more angular; the depression below the head, internal to the capital shaft ridge extends distally to the line of the distal edge of the incomplete bicipital crest. The bone is too poorly preserved for accurate measurements.

The coracoid from Upper Oso Dam resembles that of M. milleri in its straight shaft and narrow sternal facet. It is, however, shorter than the smallest known coracoid of M. milleri, and is further distinguished as follows: triosseal canal angular at the anterior edge, with tip of furcular facet projecting farther anteriorly; anterior surface of shaft evenly rounded throughout its length, lacking the flattening and internal projection, distally, characteristic of M. milleri. Greatest length 34.3 mm; M. milleri minimum (Howard, 1970:8), 38.5 mm.

DISCUSSION. These three bones represent the only alcid material collected from the Upper Oso Dam localities. No species of the family Alcidae has ever been found in the ^{contemporaneous} Sharktooth Hill Bonebed, but at least five genera are represented among the 27 alcid bones recorded (Howard, 1968) from the lower part of the ^{geologically younger} Monterey Formation (Leisure World site, LACM locality 1945), the type locality of Alcodes ulnulus. The genus had not been previously recorded elsewhere.

As originally described, Alcodes was placed, somewhat questionably, in the subfamily Mancallinae because of its apparent adaptations to flightlessness. More recent surveys of the flightless alcids has led Olson (1985) and Chandler (in lit.) to question the need to recognize a subfamily distinction (Mancallinae) even for Mancalla.

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These fossils are from a coarse elastic unit referred to the Topanga Formation.

CONCLUSIONS

Fossil marine birds have been discovered in a vertebrate assemblage in Middle Miocene rocks ^{at Upper Oso Dam, in Mission Viejo,} that underlie the Monterey Formation, the source of ^{the most} previously described Late Miocene birds in Orange County, ^{California.} The poor preservation of the avian material from the ^{Upper} Oso Dam site ~~in Mission Viejo~~ has made difficult the specific assignment of the 54 avian bones represented. They are, however identifiable as follows (number of bones in parentheses):

Family Diomedidae -- Albatrosses

Diomedea ?milleri Howard, 1966 (2)

Family Procellariidae -- Shearwaters, et al.

Puffinus priscus Miller, 1961 (10)

Puffinus [#]?n.sp. (3)

Puffinus spp. (13)

Family Sulidae -- Boobies and Gannets

Sulidae, two spp. (22)

Family Anatidae -- Water Fowl

Tribe Mergini, genus and species undetermined (1)

Family Alcidae -- Auks, et al.

Alcodes ?ulnulus Howard, 1968 (3)

The age of the sandstone deposits bearing these fossils at Upper Oso Dam is considered to be approximatey correlative ^{with} ~~to~~ the Sharktooth Hill Bonebed in the upper part of the Round Mountain Silt in Kern County, California. Therefore special attention was given to comparison of the avian material from that site, which contains more than twice the number of bird bones represented at the Upper Oso Dam site.

Of the nine avian families now recognized (Howard, 1984) in the Sharktooth Hill ~~local~~ ^{fauna}, only four are represented at the Upper Oso Dam site. The

albatross is questionably assigned to P. milleri^{known} from Sharktooth Hill. One species, the shearwater, Puffinus priscus, definitely occurs at both localities. It is possible that one or both of the other species of Puffinus described from Sharktooth Hill are also represented in the material assigned to ~~the~~^{the} genus from Upper Oso Dam.

The solid bones suggest the presence of two species at the Orange County locality, as in the Sharktooth Hill Bonebed. It is anticipated that ^{Kenneth I.}Warheit's study of this family, now under way at the University of California, Berkeley, will result in more definite identification.

A single anseriform femur documents the occurrence at Upper Oso Dam of a large diving anatinid distinct from the previously named Sharktooth Hill species, Presbychen abavus Wetmore 1930, but at least congeneric with an undescribed species from the same bonebed in Kern County (Howard, in preparation).

Of particular interest are three bones of a species of Alcidae assigned to the primitive, flightless auk, Alcodes Howard, 1968. No specimens representing the Alcidae have ever been found in the Sharktooth Hill Bonebed. The genus Alcodes is, however, well represented in the younger, Late Miocene Monterey Formation^{exposed nearby} in Laguna Hills, Orange County (LACM locality 1945, the type locality of Alcodes ulnulus).^{PU}

The fossil bird assemblage from Upper Oso Dam is the oldest known in Orange County and the only Middle Miocene one yet described from California aside from that in the Sharktooth Hill Bonebed, approximately 200 miles to the north. This is also the southernmost documented occurrence of Middle Miocene marine birds in western North America. The Orange County site is on the opposite side of the San Andreas fault from the Sharktooth Hill Bonebed, and, accounting for prior lateral displacement, might have originally been considerably farther south in Middle Miocene time. This may explain why flightless auks have never been found in the Kern County fossil record but are relatively common in Orange County. ^{The group may have been typical or might have had a more southerly distribution.}

New page

ACKNOWLEDGMENTS

My thanks go to the members of the Vertebrate Paleontology staff of LACM for the opportunity ~~of~~^{to} studying ~~the~~ this material, and particularly to Lawrence G. Barnes for information supplied with regard to the geology of the area and ~~the~~^{the} methods of collecting. In addition to Museum present and former[↑] staff members L.G. Barnes, R.M. McKenzie, B.J. Welton and R.E. Raschke, the following volunteers assisted in collecting the material: Joan C. Brown, Claire Heron, Raymond L. Price and Diana M. Weir. Susan E. Barnes and Lorraine Vasquez helped in preparing and editing the manuscript for publication.

*↑
Add sentence from Figure Captions*

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FIGURE CAPTIONS ← New page

Figure 1. A-B Puffinus priscus, right humerus, LACM 120416, palmar and external views; C. Diomedea ?milleri right ulna, LACM 120439, internal view; D-E Puffinus ?n. sp. right humerus, LACM 120422 palmar and anconal views; F-G Puffinus priscus right ulna, LACM 120416, palmar and internal views; H-I left ulnae Alcodes, H holotype A. ulnulus LACM 18277 from Laguna Hills locality LACM 1945, I A. ?ulnulus, LACM 120434 from Oso Dam locality LACM 4546. J-L Alcodes ?ulnulus, J left humerus, LACM 120414, anconal view; K-L right coracoid, K posterior view, L anterior view. All figs. natural size except H and I x $1\frac{1}{2}$

Photographs by John De Leon, LACM Staff Photographer

to Acknowledgments

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- Recliners Repaired
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MIDDLE MIOCENE BIRDS FROM THE FOOTHILLS
OF THE SANTA ANA MOUNTAINS, ORANGE COUNTY,
CALIFORNIA

By
Hildegarde Howard ¹

(upper case)

Entered by Susan Barnes 7 May 1986

Edited and proof read by Lorraine Vasquez, 9-12 May 1986.

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ABSTRACT

A marine vertebrate assemblage of Middle Miocene age has been recovered from the foothills of the Santa Ana Mountains in Orange County, California. Several localities on both sides of Oso Creek produced fossils. Among these fossils, 54 avian bones represent Diomedea milleri? (albatross), Puffinus priscus, Puffinus ?n.sp., Puffinus spp. (shearwaters), Sulidae (boobies and gannets 2 species) Anatidae (undescribed large diving duck) and Alcodes ?ulnulus (flightless auk). These comprise the oldest fossil avifauna yet described in the Orange County area, and the only ones of Middle Miocene age from south of the outcrops of the Sharktooth Hill Bonebed in Kern County. Closest affinities are with birds from the Sharktooth Hill Bonebed, of the same age, in Kern County, California. The early flightless auk, Alcodes, is known, however, only from slightly younger strata in the Monterey Formation in Laguna Hills, Orange County.

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INTRODUCTION

From 1978 to 1983 the Natural History Museum of Los Angeles County collected fossils in Middle Miocene marine sediments exposed in the foothills of the Santa Ana Mountains in the north part of Mission Viejo, Orange County, California (Raschke, 1984). The material was exposed during the grading of hills on both sides of Oso Creek during construction of an earth-fill dam, named later Upper Oso Dam. The subjects of the present study are the 54 bird bones, representing 34 individuals. These are from LACM localities 4545, 4546, and 4547, in descending order of stratification, in coarse sand deposits which underlie shales and siltstones referred to the Late Miocene Puente and Monterey Formations in this area, (and have been referred to the Topanga Formation (Morton, et al, 1973).

(The Topanga Formation, in its type area in the Santa Monica Mountains many miles to the north within the Los Angeles Basin, has been upgraded to the status of a group (Yerkes et al, 1979) and the name is probably no longer applicable in Orange County.) The sediments are older than those of the bird-bearing Monterey Formation that have been previously reported (Howard 1966, 1968, 1976, 1978)

skip ()
in Orange County ^{from} in horizons in ~~from~~ Laguna Hills (Leisure World) and Laguna Niguel several miles to the southwest, and are roughly comparable in age to the Sharktooth Hill local fauna in the Middle Miocene Round Mountain Silt to the north, in Kern County. Fossil avian species have been described from the Sharktooth Hill Bonebed by Wetmore (1930), Miller (1961, 1962), Howard (1966, 1984), and Warter (1976). That deposit is correlated with the Barstonian

Land Mammal Age, and is approximately 14 to 15 million years old (Barnes, 1977).

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page 3A

Orange County described here²

Unfortunately, many of the bones from ~~Mission Viejo~~ are not only fragmented, but crushed and ~~misshapen~~^{distorted}. Specific identification has, therefore, been difficult. Five families are recognized, with ~~greatest~~^{most abundant} representation ~~in~~^{of among} the shearwaters, Family Procellariidae (26 bones, 19 individuals), and the booby-gannet family, Sulidae (22 bones, 10 individuals). Others are of the albatross family, Diomedidae (2 bones of 1 individual), waterfowl family, Anatidae (1 bone) and auk family, Alcidae (3 bones of 3 individuals). At least eight species are represented.

Both the ~~Procellariidae~~^{families} and ~~the~~^{the} Sulidae are well represented in the fossil record, ~~and~~^{and} seven species of Sulidae and eight species of Procellariidae (including 2 fulmars) have been described from California's Miocene deposits. A thorough study of each of these families is, therefore, in order. The Sulidae are now in process of ~~review~~^{being} ~~ed~~^{ed} by Kenneth I. Warheit of the Department of Paleontology at the ~~University~~^{University} of California, Berkeley.

Assignments herein of the ~~Mission Viejo~~ shearwater and booby-gannet material ~~species~~ should be considered tentative.

METHODS AND MATERIALS

Acronyms used for institutions are:

CAS - California Academy of Sciences, San Francisco

LACM - Natural History Museum of Los Angeles County, Los Angeles

UCLA - University of California at Los Angeles, California

UCMP - University of California, Museum of Paleontology, Berkeley,
California

UCMVZ- University of California, Museum of Vertebrate Zoology,
Berkeley, California

USNM - United States National Museum of Natural History, Washington,
D.C.

In addition to the fossil material in the LACM collections, referred material and casts of types from CAS, UCMP, UCLA and USNM have been available for this study. Modern skeletal material is from the LACM collections, with the exception of specimens of Aethia from UCMVZ.

The locality number LACM 4464 is applied to material found as float from LACM localities 4545, 4546, and 4547, but of no precise provenience.

Classification follows that of the 1983 edition of the American Ornithologists' Union Checklist of North American Birds.

SYSTEMATICS

ORDER PROCELLARIIFORMES

Family Diomedidae -- Albatrosses

Genus Diomedea Linnaeus, 1758Diomedea ?milleri Howard, 1966

MATERIAL. Associated proximal half of right ulna and distal end and shaft fragments of radius LACM 120439 from LACM locality 4547.

DISCUSSION. Albatross bones have been previously reported from several Miocene age sites in California, but only two species, both from the Sharktooth Hill Bonebed, have been described: Diomedea californica Miller, 1962 and D. milleri Howard, 1966. The holotype of D. californica is a tarsometatarsus, slightly larger than that of the modern albatross, D. albatrus, but not as large as that of D. exulans. D. milleri was of markedly smaller size.

The holotype of D. milleri is a proximal end of an ulna with a proximal breadth of 14.4 mm, as compared to 17.6 mm for that of the living D. nigripes (see Howard, 1966:4). The ulna, LACM 120439, from the Upper Oso Dam site measures 15.8 mm. The associated radius is also narrower of shaft than in D. nigripes. The area immediately distal to the ulnar cotylae, which contains the diagnostic characters of the species D. milleri, is crushed in LACM 120439. However, a clearly defined ridge on the palmar side of the shaft below this area suggests that there was a distinct angle between the palmar and internal surfaces of the shaft immediately below the internal cotyla as described for D. milleri. Although LACM 120439 appears to have a more prominent acromion and external cotyla than in the holotype of D. milleri, these areas are slightly eroded in the latter.

Family Procellariidae -- Shearwaters

Genus Puffinus Brisson, 1760Puffinus priscus Miller, 1961

REFERRED MATERIAL. Left humerus, LACM 120415; associated right and left humeri and incomplete right ulna, LACM 120416; distal end of right humerus, LACM 120417; proximal fragment of left ulna, LACM 120424, all from locality LACM 4546. Proximal three-fourths of right humerus, LACM 126159, from locality 4464.

TENTATIVELY REFERRED MATERIAL. Right and left distal ends of tibiotarsi, LACM 120425 (right) and 120426 (left); right tarsometatarsus lacking proximal end, LACM 120419, all from locality 4546.

DISCUSSION. The humeri agree in general conformation, size and flatness of shaft with the holotype distal end of this element from the Sharktooth Hill Bonebed and/or additional unpublished specimens (three of which - LACM 18140, LACM 44556 and LACM 126219 - are complete) from the same locality, now referred to Puffinus priscus. Measurements of Oso Dam humeri are: length 79.3-81.2 mm, breadth distal condyles 7.4-7.7 mm, distance from distal surface of condyles to proximal surface of ectepicondylar prominence 9.5-9.9 mm. The same measurements in Sharktooth Hill humeri assigned to P. priscus are: length 80.3-82.5 mm, breadth distal condyles 7.1-7.7 mm (holotype 7.5 mm), and distance from distal condyles to proximal surface of ectepicondylar prominence 8.9-10.0 mm (holotype 9.5 mm).

The two ulnae, one of which is associated with humeri LACM 120416, have a high pointed olecranon (possibly exaggerated by crushing in this area) and long, pointed and upturned external cotyla. These characters are suggestive of those of modern P. opisthomelas, though to an exaggerated degree.

✓ The tarsometatarsus, which measures 6.1 mm in distal breadth, ¹⁵ in tentatively assigned to P. priscus on the basis of favorable comparison with tarsometatarsi

from Sharktooth Hill. Of the three Puffinus tarsometatarsi now available from the latter locality, one incomplete distal half (LACM 104058), which agrees in size with LACM 120419 from Orange County, is slightly smaller than the other two and I believe is assignable to P. priscus.

The tibiotarsi resemble the only distal end of this element that has been found at Sharktooth Hill, LACM 122994, a specimen which is tentatively referred to P. priscus on the basis of its size relative to that of the tarsometatarsi noted above.

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Puffinus sp., possible ~~undescribed~~ ^y

REFERRED MATERIAL. Associated complete, but poorly preserved, right humerus, crushed proximal end of ulna and proximal and distal fragments of radius, LACM 120422, from locality LACM 4546. Collected 23 April, 1980 by L. G. Barnes.

DESCRIPTION. The humerus is notably distinguishable from the holotype of P. priscus Miller, 1961 (UCMP 58185), but less so from the holotype of P. mitchelli Miller, 1961 (UCMP 58184) (casts of which are at hand) in having a more rounded, less flattened shaft. In length, it is intermediate between specimens from Sharktooth Hill referred to these species; LACM 120422, 90.4 mm; Sharktooth Hill P. priscus specimens 80.2-82.5 mm, one measureable specimen of P. mitchelli (LACM 17500) 98.1 mm. The ulna is severely crushed and measures only 7.0 mm across the cotylae. The olecranon is crushed to a point.

DISCUSSION. Poor preservation of the Upper Oso Dam humerus makes difficult any detailed comparison with P. inceptor Wetmore, 1930. A cast of the holotype distal end of humerus of P. inceptor (CAS 5223) is available. The Oso Dam specimen is broken through the internal trochlea, but appears to lack the notable internal thrust of the distal end which is characteristic of P. inceptor, and is reflected in the measurements given by Wetmore (1930:87): breadth of shaft 5.9 mm, greatest distal breadth 12.2 mm. In the Oso Dam humerus, the shaft breadth is 6.3 mm, distal breadth 11.2 mm.

Other Miocene members of the genus Puffinus recorded from California include P. diatomicus Miller, 1925 from the Late Miocene Sisquoc Formation in Santa Barbara County in which the humerus is included in the holotype and referred skeletal impressions. Miller recorded the length of these humeri as 80-84 mm (considerably smaller than LACM 120422). The humerus is the holotype of the two Late Miocene Orange County species, P. calhouni Howard, 1968 and P. barnesi Howard, 1978. Both are smaller and have a more compressed shaft than in LACM

120422. Compared with the holotype distal end of the Early Miocene P. micraulax Brodkorb, 1963 from Florida, LACM 120422 is broader. The holotype distal end of humerus of P. conradi March, 1970, from the Middle Miocene Calvert Formation of Maryland, is broader and has a heavier shaft.

The poor condition of LACM 120422 precludes naming a species with this material as holotype. Should more specimens assignable to this shearwater become available, studies should also be made of the French Middle Miocene species, P. aquitanicus (Milne-Edwards, 1874), P. antiquus (Milne-Edwards, 1874) and P. arvernensis Milne-Edwards, 1971, redescribed by Shufeldt, 1896. In fact, Olson (1985:211) has noted the need for a world-wide revision of fossils assigned to the genus Puffinus.

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Puffinus spp.

REFERRED MATERIAL. Complete right ulna, LACM 120420; distal 3/4 left ulna, LACM 124360; proximal and distal ends of right ulna LACM 120421; fragment of proximal end of left ulna, LACM 126155; associated fragments of distal end of ulna and proximal end of radius and carpmetacarpus, LACM 126156; complete radius, LACM 120423; right caropmetacarpus, LACM 120419; associated fragments of distal end of left ulna and tarsometatarsal shaft, LACM 126157; all from locality LACM 4546. Distal fragment of radius, LACM 120412; incomplete right humerus, LACM 126160 from locality LACM 4464.

DISCUSSION. Size alone suggests that at least two species are represented by this material. Most of the specimens are of the small size suggestive of P. priscus. One poorly preserved humerus (LACM 126160) and one ulna (LACM 120420) are, however, notable larger. The humerus has been partly restored, but appears to have a more flattened shaft toward the distal half of the bone than do humeri of P. mitchelli from Sharktooth Hill. The length of this poorly preserved humerus, from proximal edge of brachial impression to head is 83.2 mm. The same measurement of a Sharktooth Hill humerus, LACM 17500, referred to P. mitchelli, is 86.6 mm. The ulna, LACM 120420, has a length of 95.7 mm. By contrast, the longest ulna known from the Sharktooth Hill Bonebed (LACM 124359) measures only 88.2 mm. Both are markedly larger than the incomplete Upper Oso Dam ulna (LACM 120416) which is associated with the humerus assigned herein to P. priscus.

ORDER PELECANIFORMES

Famile Sulidae -- Boobies and Gannets

Sulidae, spp.

REFERRED MATERIAL. Associated right and left humeri, ulnae, and badly crushed radius, LACM 120433; associated left coracoid and proximal fragment of

shaft of left humerus, LACM 120428; right tarsometatarsus lacking part of proximal end, LACM 120432; proximal end of radius, LACM 120429; proximal end of humerus, LACM 120430; distal end of humerus, LACM 120431; skull fragment, LACM 120427 all from locality 4546. Associated incomplete radius and ulna, LACM 120438; humerus, LACM 123910; associated seven incomplete and poorly preserved bones lying together in matrix with the following elements represented: incomplete mandible, proximal end of right humerus, three fragments of left humerus, fragment of left ulna, distal end of right radius, proximal end of left radius overlying left carpometacarpus, LACM 126161 all from locality LACM 4547.

DISCUSSION. This material will be included in Warheit's study of the family Sulidae. In my brief examination of the material from Upper Oso Dam, I noted two humeri (LACM 120433, 120431) which exceed in measurements specimens of Morus vagabundus Wetmore, 1930, the only sulid species described from the Sharktooth Hill Bonebed. The distal breadth of the holotype of M. vagabundus is 18.3 mm; the same measurement in LACM 120431 is 21.0 mm; length of referred humerus of M. vagabundus, 170 mm (Howard 1966:6), length of LACM 120433, 183 mm. On the other hand, the Upper Oso Dam specimens LACM 120428, 120432, and 120438, though difficult to measure exactly, suggest a smaller species.

That more than one species of sulid occurs in the Sharktooth Hill Bonebed was noted by Miller (1961:401), who reported a proximal fragment of ulna of larger size than the one referred by M. vagabundus by Wetmore (1930). Also, Howard (1966:7) recorded two tarsometatarsi which differ in qualitative characters as well as in size.

ORDER ANSERIFORMES

Family Anatidae -- Ducks, Geese and Swans

Subfamily Anatinae -- Ducks

Tribe Mergini -- Divers

REFERRED SPECIMEN. Distal end of left femur, LACM 125994, from locality LACM 4546, collected by Museum field party, 1981.

DESCRIPTION. The fibular condyle is thrust laterally, and there is deep angular depression above the condyles, posteriorly, as in diving ducks such as those of the genera Somateria, Mergus and Melanitta, but the specimen is markedly larger than in living species of these genera. The breadth of the distal end is 20.7 mm.

DISCUSSION. This femur represents a large diving anatid, goose-like in size, and in general conformation suggestive of undescribed specimens of femora from the Sharktooth Hill Bonebed. It is, however, more slender, and the muscle scar on the internal side of the posterior face is more proximally placed. Anteriorly the intercotylar area appears to be more deeply excavated, but allowance must be made for the poor preservation of the specimen.

The femora and other related elements of the skeleton from the Sharktooth Hill Bonebed are still under study. It is anticipated that a new species, and probably a new genus, will be proposed. The single femur from Upper Oso Dam indicates the presence of a large diving anatid in the Orange County area at the same time as the existence of such a bird--probably congeneric, but specifically distinct--in the Kern County area.

ORDER CHARADRIIFORMES

Family Alcidae -- Auks et al

Genus Alcodes Howard, 1968Alcodes ?ulnulus Howard, 1968

MATERIAL. Left ulna, LACM 120434 from locality LACM 4546; left humerus, LACM 120414, from locality LACM 4545; right coracoid, LACM 121010 from locality LACM 4547.

DESCRIPTION. The holotype of Alcodes ulnulus is a complete left ulna (LACM 18277), with a distal end of a right ulna (LACM 18279) and the proximal end of right carpometacarpus (LACM 18278) referred to the species (Howard, 1968). An incomplete proximal portion of right ulna (LACM 18280, ten percent larger than the holotype, was tentatively referred in the same publication.

The ulna from Upper Oso Dam is not as well preserved as the holotype, but resembles it by having a relatively heavy shaft for such a short bone. It is, however, slightly longer, and relatively narrower than the holotype. In contrast, the ulna from a Recent specimen of the Least Auklet, Aethia pusilla (UCMVZ 60629), is longer and narrower, and that of the Pliocene flightless auk-like swimmer, Mancalla milleri Howard, 1966, is shorter and broader. Although Alcodes had evolved in the direction of flightlessness, it is clearly not as far advanced as Mancalla.

The humerus, LACM 120414, though incomplete, resembles the paratype specimen of the Pliocene Mancalla milleri Howard, 1970 (LACM 2813) in the compression of the distal end and the height of its ectepicondylar prominence. The deltoid crest, however, is not as extensive as in M. milleri, and the shaft is narrower throughout. Other distinctive characters, peculiar to the Upper Oso Dam specimen are: proximally the pectoral attachment and external tuberosity are distinctly external to the capital shaft ridge, separated from the ridge by a depression,

and the ridge is more angular; the depression below the head, internal to the capital shaft ridge extends distally to the line of the distal edge of the incomplete bicapital crest. The bone is too poorly preserved for accurate measurements.

The coracoid from Upper Oso Dam resembles that of M. milleri in its straight shaft and narrow sternal facet. It is, however, shorter than the smallest known coracoid of M. milleri, and is further distinguished as follows: triosseal canal angular at the anterior edge, with tip of furcular facet projecting farther anteriorly; anterior surface of shaft evenly rounded throughout its length, lacking the flattening and internal projection, distally, characteristic of M. milleri. Greatest length 34.3 mm; M. milleri minimum (Howard, 1970:8), 38.5 mm.

DISCUSSION. These three bones represent the only alcid material collected from the Upper Oso Dam localities. No species of the family Alcidae has ever been found in the Sharktooth Hill Bonebed, but at least five genera are represented among the 27 alcid bones recorded (Howard, 1968) from the lower part of the Monterey Formation (Leisure World site, LACM locality 1945), the type locality of Alcodes ulnulus. The genus had not been previously recorded elsewhere.

✓ As originally described, Alcodes was placed, somewhat questionable ^g in the subfamily Mancallinae because of its apparent adaptations to flightlessness. More recent surveys of the flightless alcids has led Olson (1985) and Chandler (in lit.) to question the need to recognize a subfamily distinction (Mancallinae) even for Mancalla.

CONCLUSIONS

Fossil marine birds have been discovered in a vertebrate assemblage in Middle Miocene rocks that underlie the Monterey Formation, the source of previously described Late Miocene birds in Orange County. The poor preservation of the avian material from the Oso Dam site in Mission Viejo has made difficult the specific assignment of the 54 avian bones represented. They are, however identifiable as follows (number of bones in parentheses):

Family Diomedidae -- Albatrosses

Diomedea ?milleri Howard, 1966 (2)

Family Procellariidae -- Shearwaters et al

Puffinus priscus Miller, 1961 (10)

Puffinus ?sp. (3)

Puffinus spp. (13)

Family Sulidae -- Boobies and Gannets

Sulidae, two spp. (22)

Family Anatidae -- Water Fowl

Tribe Mergini genus and species undetermined (1)

Family Alcidae -- Auks et al

Alcodes ?ulnulus Howard, 1968 (3)

The age of the sandstone deposits bearing these fossils at Upper Oso Dam is considered to be approximatey correlative to the Sharktooth Hill Bonebed in the upper part of the Round Mountain Silt in Kern County, California. Therefore special attention was given to comparison of the avian material from that site, which contains more than twice the number of bird bones represented at the Upper Oso Dam site.

Of the nine avian families now recognized (Howard, 1984) in the Sharktooth Hill local fauna, only four are represented at the Upper Oso Dam site. The

albatross is questionably assigned to P. milleri from Sharktooth Hill. One species, the shearwater, Puffinus priscus, definitely occurs at both localities. It is possible that one or both of the other species of Puffinus described from Sharktooth Hill are also represented in the material assigned to the genus from Upper Oso Dam.

The solid bones suggest the presence of two species at the Orange County locality as in the Sharktooth Hill Bonebed. It is anticipated that Warheit's study of this family, now under way at the University of California, Berkeley, will result in more definite identification.

A single anseriform femur documents the occurrence at Upper Oso Dam of a large diving ~~goose~~ ^{anatid} distinct from the previously named Sharktooth Hill species, Presbychen abavus Wetmore 1930, but at least congeneric with an undescribed species from the same bonebed in Kern County (Howard, in preparation).

Of particular interest are three bones of a species of Alcidae assigned to the primitive, flightless auk, Alcodes Howard, 1968. No specimens representing the Alcidae have ever been found in the Sharktooth Hill Bonebed. The genus Alcodes is, however, well represented in the younger, Late Miocene Monterey Formation in Laguna Hills, Orange County (LACM locality 1945, the type locality of Alcodes ulnulus.)

The fossil bird assemblage from Upper Oso Dam is the oldest known in Orange County and the only Middle Miocene one yet described from California aside from that in the Sharktooth Hill Bonebed approximately 200 miles to the north. This is also the southern-most documented occurrence of Middle Miocene marine birds in western North America. The Orange County site is on the opposite side of the San Andreas fault from the Sharktooth Hill Bonebed, and, accounting for prior lateral displacement, might have originally been considerably farther south in Middle Miocene time. This may explain why flightless auks have never been found in the Kern County fossil record but are relatively common in Orange County.

ACKNOWLEDGMENTS

My thanks go to the members of the Vertebrate Paleontology staff of LACM for the opportunity of studying this material, and for information supplied with *particularly to Lawrence G. Barnes* regard to the *geology of the area and* methods of collecting. In addition to Museum present and former staff members L.G. Barnes, R.M. McKenzie, B.J. Welton and R.E. Raschke, the following volunteers assisted in collecting the material: Joan C. Brown, Claire Heron, Raymond L. Price and Diana M. Weir. *Susan E. Barnes and Lorraine Vasquez helped in preparing and editing the manuscript for publication.*

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alcid

Table 1. Measurements of Ulnae (in millimeters).

	<u>Alcodes ulnulus</u>	<u>A. ?ulnulus</u>	<u>Aethia</u>	<u>Mancalla</u>
	holotype	LACM 120434	<u>pusilla</u> UCMVZ 60629	<u>milleri</u> minimum
Internal length	27.4	29.4	32.5	23.6
Breadth/depth				
→ of shaft	2.9/4.9	2.9/3.9	1.6/2.7	3.2/5.3



Department of Vertebrate Paleontology
September 11, 1986

Dr. John Harris, Chief Curator
Division of Earth Sciences

Dear Dr. Harris:

Enclosed is my paper entitled "Middle Miocene Birds from the Foothills of the Santa Ana Mountains, Orange County, California." I hope you will find it suitable for publication in the Museum's Contributions in Science.

The fossil avifauna discussed is older than any heretofore found in Orange County and is, in fact, more closely related to that found in the Sharktooth Hill Bonebed in Kern County.

The paper comprises 20 typewritten pages plus one full page illustration.

Sincerely,

Hildegarde Howard
Chief Curator Emeritus

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MIDDLE MIOCENE BIRDS FROM THE FOOTHILLS
OF THE SANTA ANA MOUNTAINS, ORANGE COUNTY, CALIFORNIA

By
Hildegarde Howard¹

¹Chief Curator Emeritus, Natural History Museum of Los Angeles County

ABSTRACT. The 54 poorly preserved avian bones from Middle Miocene deposits near Upper Oso Dam in Mission Viejo, Orange County, California, represent Diomedea sp., Puffinus priscus, Puffinus ?n. sp., Puffinus sps., Sulidae (2 species under study at University of California, Berkeley), Anatidae (undescribed diving goose) and Alcodes ?ulnulus. Particular comparisons are made with specimens from beds of the same age at Sharktooth Hill, Kern County, California. However, Alcodes is known only from the slightly later Monterey Formation deposits in Laguna Hills, Orange County.

MIDDLE MIOCENE BIRDS FROM MISSION VIEJO
ORANGE COUNTY, CALIFORNIA

By Hildegard Howard

INTRODUCTION

From 1978 to 1983 the Natural History Museum of Los Angeles County collected fossils in Miocene marine sediments in Mission Viejo, Orange County, California. The material was exposed in the grading of a hill on the east side of Oso Creek during construction of a small lake behind Upper Oso Dam. Of interest for the present study are 54 bird bones, representing 34 individuals.

Numbered as LACM localities 4545, 4546 and 4547 in descending order of stratification, the bird-bearing deposits underlie the siltstone of the Late Miocene Puente Formation and/or Monterey Formation in this area, and have been referred to the Topanga Formation. They are, therefore, older than the bird-bearing Monterey Formation deposits reported (Howard, 1968) from Leisure World, Laguna Hills (LACM locality 1945) $6\frac{1}{2}$ miles to the southwest in Orange County, and are seemingly more closely comparable in age to the Middle Miocene Round Mountain Silt deposits at Sharktooth Hill to the north, in Kern County. Fossil avian species have been described from Sharktooth Hill by Wetmore (1930), Miller (1961 and 1962), Howard (1966 and 1984) and Warter (1976).

Unfortunately, many of the bones from Mission Viejo are not only fragmented, but crushed and misshapen. Specific identification has, therefore, been difficult. Five families are recognized, with greatest representation in the shearwaters, Family Procellariidae (26 bones, 19 individuals) and the booby-gannet family, Sulidae (22 bones, 10 individuals). Others are of the albatross family, Diomedidae (2 bones of 1 individual), waterfowl family, Anatidae (1 bone) and auk family, Alcidae (3 bones of 3 individuals). At least eight species are represented.

Both the Procellariidae and the Sulidae are well represented in the fossil record. Seven species of Sulidae and eight species of Procellariidae (including 2 fulmars) have been described from California's Miocene deposits. A thorough study of each of these families is, therefore, in order. The Sulidae are now in process of review by Kenneth I. Warheit of the Department of Paleontology at the University of California, Berkeley.

Assignments herein of the Mission Viejo shearwater and booby-gannet material ~~species~~ should be considered tentative.

METHODS AND MATERIALS

Acronyms used: CAS California Academy of Sciences

LACM Natural History Museum of Los Angeles County

UCLA University of California at Los Angeles

UCMP University of California, Berkeley
Museum of Paleontology

UCMVZ University of California, Berkeley
Museum of Vertebrate Zoology

USNM United States National Museum

In addition to the fossil material in the LACM collections, referred material and casts of types from CAS, UCMP, UCLA and USNM have been available for this study. Modern skeletal material is from the LACM collections, with the exception of specimens of Aethia, kindly loaned by UCMVZ.

The locality number LACM 4464 is applied to material of uncertain origin found as float from LACM localities 4545, 4546 and 4547.

ACKNOWLEDGMENTS

My thanks go to the members of the Vertebrate Paleontology staff of LACM for the opportunity of studying this material, and for information supplied with regard to the methods of collecting. In addition to Museum staff members L.G. Barnes, R. M. McKenzie, B. Welton and R.E. Raschke, the following volunteers assisted in collecting the material: Joan Brown, Claire Heron, R. L. Price and Diana M. Weir.

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SYSTEMATICS

ORDER PROCELLARIIFORMES

Family Diomedidae -- Albatrosses

Genus Diomedea Linnaeus

Diomedea sp.

Referred material. From LACM locality 4547: associated proximal half of right ulna and distal end and shaft fragments of radius, LACM 120439.

Discussion. Albatross bones have been cited from several Miocene sites in California, but only two species have been described, both from Sharktooth Hill: Diomedea californica Miller 1962 and D. milleri Howard 1966. The holotype of D. californica is a tarsometatarsus, slightly larger than that of the modern albatross, D. albatrus, but not as large as that of D. exulans. D. milleri was of markedly smaller size.

The holotype of D. milleri is a proximal end of ulna with a proximal breadth of 14.4 mm, as compared to 17.6 mm for that of the living D. nigripes (Howard 1966:4). Ulna LACM 120439 from the Mission Viejo site measures 15.8 mm. The fossil radius is also narrower of shaft than in D. nigripes. The area below the ulnar cotylae, which contains the diagnostic characters of the species D. milleri, is crushed in LACM 120439. It appears, however, to have a more prominent acromion and external cotyla than in the holotype of D. milleri.

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Family Procellariidae -- Shearwaters

Genus Puffinus Brisson

Puffinus priscus Miller 1961

Referred material. From locality LACM 4546, left humerus, LACM 120415; associated right and left humeri and incomplete right ulna, LACM 120416; distal end of right humerus, LACM 120417; proximal fragment of left ulna, LACM 120424. From locality 4464: proximal 3/4 right humerus, LACM 126159.

Tentatively referred material. From locality 4546: right and left distal ends of tibiotarsi, LACM 120425 (right) and 120426 (left); right tarsometatarsus lacking proximal end, LACM 120419.

Discussion. The humeri agree in size, flattened shaft, and general conformation with the holotype distal end of this element from Sharktooth Hill and/or additional specimens (three of which --LACM 18140, LACM 44556 and LACM 126219--are nearly complete) from that locality, now referred to P. priscus. Measurements of Mission Viejo humeri: length 79.3-81.2 mm, breadth distal condyles 7.4-7.7 mm, distance from distal surface of condyles to proximal surface of ectepicondylar prominence 9.5-9.9 mm. Same measurements in Sharktooth Hill humeri assigned to P. priscus: length 80.3-82.5 mm, breadth distal condyles 7.1-7.7 mm (type 7.5 mm) and distance from distal condyles to proximal surface of ectepicondylar prominence 8.9-10.0 mm (type 9.5 mm).

The two ulnae, one of which is associated with humeri LACM 120416, have a high, pointed olecranon (possibly exaggerated by crushing in this area) and long, pointed and upturned external cotyla. These characters are suggestive of those of modern P. opisthomelas, though to an exaggerated degree.

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The tarsometatarsus, which measures 6.1 mm in distal breadth, is tentatively assigned on the basis of comparison with tarsometatarsi from Sharktooth Hill. Of the three Puffinus tarsometatarsi now available from that Kern County locality, one incomplete distal half (LACM 104058), which agrees in size with LACM 120419 from Mission Viejo, is slightly smaller than the other two and is believed to be assignable to P. priscus.

The tibiotarsi resemble the only distal end of this element found at Sharktooth Hill, LACM 1222994, which is tentatively referred to P. priscus on the basis of size relative to the tarsometatarsi above noted.

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Puffinus ?n. sp.

Referred material. From locality L, ACM 4546: associated complete, but poorly preserved, right humerus, crushed proximal end of ulna and proximal and distal fragments of radius, LACM 120422. Collected April 23, 1980 by ..G. Barnes.

Description. The humerus is notably distinguished from the holotype of P. priscus Miller 1961 (UCMP 58185) and to a lesser degree from the holotype of P. mitchelli Miller 1961 (UCMP 58184), casts of which are at hand, in having a more rounded, less flattened shaft. In length it falls between LACM specimens from Sharktooth Hill referred to these species: LACM 120422, 90.4mm; Sharktooth Hill P. priscus specimens 80.2-82.5 mm, one measureable specimen of P. mitchelli (LACM 17500) 98.1 mm. The ulna is severely crushed and measures only 7.0^{mm} across the cotylae. The olecranon is crushed to a point.

Discussion. Poor preservation of the Upper Oso Dam humerus makes difficult detailed comparison with P. inceptor Wetmore 1930. A cast of the holotype distal end of humerus of P. inceptor (CAS 5223) is at hand. The Mission Viejo specimen is broken through the trochlea internal, but appears to lack the notable internal thrust of the distal end characteristic of P. inceptor, and reflected in the measurements given by Wetmore (1930:87): breadth of shaft 5.9 mm, greatest distal breadth 12.2 mm. In the Upper Oso Dam humerus shaft breadth is 6.3 mm, distal breadth 11.2 mm.

Other Miocene members of the genus Puffinus recorded from California include P. diatomicus Miller 1925 from Santa Barbara

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County in which the humerus is included in the holotype and referred skeletal impressions. Miller records the length of these humeri as 80-84 mm (considerably smaller than LACM 120422). The humerus is the hdotype in the two Orange County Miocene species, P. calhouni Howard 1968 and P. barnesi Howard 1978. Both are smaller and have a more compressed shaft than in LACM 120422. Compared with the holotype distal end of P. micraulax Brodkorb 1963 from the early Miocene of Florida, LACM 120422 is broader. The holotype distal end of humerus of P. conradi Marsh 1970, from the Middle Miocene Calvert Formation of Maryland, is, however, broader and heavier of shaft.

The poor condition of the LACM 120422 material precludes naming a species with this as holotype. Should more specimens assignable to this shearwater become available, studies should also be made of the French middle Miocene species P. aquitanicus (Milne-Edwards 1874). P. antiquus (Milne-Edwards 1874) and P. arvernensis Milne-Edwards 1871 redescribed by Shufeldt 1896. In fact, Olson (1985:211) has noted the need for a world-wide revision of fossils assigned to this genus.

Puffinus sps.

Referred material. From locality LACM 4546: complete right ulna, LACM 120420; distal $3/4$ left ulna, LACM 124360, proximal end distal ends of right ulna 120421; fragment of proximal end of left ulna, LACM 126155; associated fragments of distal end of ulna and proximal end of radius and carpometacarpus, LACM 126156; complete radius, LACM 120423; right carpometacarpus, LACM 120419; associated fragments of distal end of left ulna and tarsometatarsal shaft, LACM 126157. Locality LACM 4464: distal fragment of radius, LACM 120412; incomplete right humerus, LACM 126160.

Discussion. Size alone suggests that at least two species are represented in this material. Most of the specimens are of the small size suggestive of P. priscus. One poorly preserved humerus (LACM 126160) and one ulna (LACM 120420), are, however, notably larger. The humerus is partially restored but appears to have a more flattened shaft toward the distal half of the bone than in humeri of P. mitchelli from Sharktooth Hill. The length of this poorly preserved humerus from proximal edge of brachial impression to head is 83.2 mm. The same measurement on Sharktooth Hill humerus LACM 17500 referred to P. mitchelli is 86.6 mm. Ulna LACM 120420 has a length of 95.7 mm. The longest ulna found at Sharktooth Hill (LACM 124359) measures only 88.2 mm. Both are markedly larger than the incomplete ^{Upper} Oso Dam ulna (LACM 120416) associated with the humerus of the same number assigned herein to P. priscus.

ORDER PELECANIFORMES

Family Sulidae -- Boobies and Gannets

Sulidae sps.

Referred material. From locality 4546: associated right and left humeri, ulnae and badly crushed radius, LACM 120433; associated left coracoid and proximal fragment of shaft of left humerus, LACM 120428; right tarsometatarsus lacking part of proximal end, LACM 120432; proximal end of radius, LACM 120429; proximal end of humerus, LACM 120430; distal end of humerus, LACM 120431; skull fragment, LACM 120427. From locality LACM 4547: associated incomplete radius and ulna, LACM 120438; humerus LACM 123910; associated seven incomplete and poorly preserved bones lying together in matrix with the following elements represented: incomplete mandible, proximal end of right humerus, three fragments of left humerus, fragment of left ulna, distal end of right radius, proximal end of left radius overlying left carpometacarpus, LACM 126161.

Discussion. This material will be included in Kenneth Warheit's study of the family Sulidae. In my brief examination of the material from Mission Viejo I noted two humeri (LACM 120433 and LACM 120431) which exceed in measurements specimens of Morus vagabundus Wetmore 1930, the one sulid species described from Sharktooth Hill. Distal breadth of holotype of M. vagabundus, 18.3 mm, same measurement in LACM 120431, 21.0 mm; length of referred humerus of M. vagabundus, 170 mm (Howard 1966:6), length of LACM 120433, 183 mm. On the other hand, Mission Viejo specimens LACM 120428, 120432 and 120438, though difficult to measure exactly, suggest a smaller form.

That more than one species of sulid occurred at Sharktooth Hill was noted by Miller (1961:401) who recorded a proximal

fragment of ulna of larger size than the one referred to M.
vagabundus by Wetmore (1930). Also, Howard (1966:7) recorded
two tarsometatarsi which differ in qualitative characters as well
as size.

ORDER ANSERIFORMES

Family Anatidae -- Ducks et al

Tribe Mergini -- Divers

Referred Material. From locality LACM 4546, distal end of left femur, LACM 125994, collected by Museum field party, 1981.

Description. Fibular condyle thrust laterally, and deep, angular depression above condyles, posteriorly, as in diving ducks such as those of the genera Somateria, Mergus and Aythya, but specimen markedly larger than in living species of these genera. Breadth of distal end 20.7 mm.

Discussion. This femur represents a large diving anatid, goose-like in size, and in general conformation suggestive of undescribed specimens of femora from the Round Mountain Silt at Sharktooth Hill. It is, however, more slender, and the muscle scar on the internal side of the posterior face is more proximally placed. Anteriorly the intercotylar area appears to be more deeply excavated, but allowance must be made for the poor preservation of the specimen.

The Sharktooth Hill femora and other related elements of the skeleton are still under study. It is anticipated that a new species, and probably a new genus, will be established. The single bone from Mission Viejo indicates the presence of a large diving anatid in the south Orange County area at the same time as the existence of such a bird--probably generically similar, but specifically distinct--in the Kern County area.

ORDER CHARADRIIFORMES

Family Alcidae -- Auks , et al

Genus Alcodes Howard 1968

Alcodes ?ulnulus Howard 1968

Referred Material. From locality LACM 4546: left ulna, LACM 120434; from locality LACM 4545, left humerus, LACM 120414; from locality ^{LACM} 4547, right coracoid, LACM 121010.

Description. The holotype of A. ulnulus is a complete left ulna (LACM 18277) with distal end of right ulna (LACM 18270) and proximal end of right carpometacarpus (LACM 18278) referred. An incomplete proximal portion of right ulna (LACM 18280), ten percent larger than the holotype, was tentatively referred.

The Oso Dam ulna is not as well preserved as the holotype, but resembles it in the relatively heavy shaft in a short bone. It is, however, slightly longer, and relatively narrower than the holotype. In contrast, the ulna from a modern specimen of Least Auklet, Aethiapusilla (UCMVZ 60629), is longer and narrower, and that of the flightless auklike swimmer of the Pliocene, Mancalla milleri Howard 1966 is shorter and broader. Although Alcodes suggests a trend toward flightlessness, it is clearly not as far advanced as in Mancalla.

Measurements of Ulnae (in millimeters)

	<u>Alcodes ulnulus</u> holotype	<u>A. ?ulnulus</u> LACM 120434	<u>Aethia</u> <u>pusilla</u> UCMVZ 60629	<u>Mancalla</u> <u>milleri</u> minimum
Internal length	27.4	29.4	32.5	23.6
Breadth/depth of shaft	2.9/4.9	2.9/3.9	1.6/2.7	3.2/5.3

Humerus 120414, though incomplete, is suggestive of the paratype specimen of ^{Howard 1970} Mancalla milleri (LACM 2813) in compression of the distal end and height of the ectepicondylar prominence. The

however
 deltoid crest, ~~though long~~, is not as extensive as in M. milleri.
 The shaft is narrower throughout. Other distinctive characters,
 peculiar to the Oso Dam specimen are: proximally the pectoral
 attachment and external tuberosity are distinctly external to
 the capital shaft ridge, separated from the ridge by a depression,
 and the ridge is more angular; the depression below the head,
 internal to the capital shaft ridge extends distally to the line
 of the distal edge of the incomplete bicapital crest. The bone
 is too poorly preserved for accurate measurements.

The coracoid resembles that of M. milleri in the straight
 shaft and narrow sternal facet. It is, however, shorter than the
 minimum for M. milleri and is further distinguished as follows:
 triosseal canal angular at the anterior edge, with tip of furcular
 facet projecting farther anteriorly; anterior surface of shaft
 evenly rounded throughout its length, lacking the flattening and
 internal projection, distally, characteristic of M. milleri.
 Greatest length 34.3 mm; M. milleri minimum (Howard, 1970:8), 38.5 mm.

Discussion. These three bones, collected in April 1979 and
 January and April 1980, represent the only alcids material from
 the Oso Dam localities. The family Alcidae is not represented
 at Sharktooth Hill, but at least five genera are noted in the
 27 alcid bones recorded (Howard, 1968) from the Leisure World
 Monterey Formation site (LACM locality 1945), the type locality
 of Alcodes ulnulus. The genus has not been recorded elsewhere.

As originally described, Alcodes was ^{somewhat reluctantly,} placed in the subfamily
 Mancallinae because of the suggested trend toward flightlessness.
 More recent surveys of the flightless alcids has led Olson (1985)
 and Chandler (in lit.) to question the validity of subfamily
 distinction even for Mancalla.

CONCLUSIONS

The poor preservation of the avian material from the Oso Dam site in Mission Viejo has made difficult the specific assignment of the 54 avian bones represented. They are, however referred as follows (number of bones in parentheses):

Family Diomedidae -- Albatrosses

Diomedea sp. (2)

Family Procellariidae -- Shearwaters et al

Puffinus priscus Miller 1961 (10)

Puffinus ? n. sp. (3)

Puffinus sps. (13)

Family Sulidae -- Boobies and Gannets

Sulidae, two sps. (22)

Family Anatidae -- Water Fowl

Tribe Mergini (1)

Family Alcidae -- Auks et al

Alcodes ?ulnulus Howard 1968 (3)

The age of the Mission Viejo deposits is considered similar to that of the Round Mountain Silt at Sharktooth Hill, in Kern County, California. Therefore special attention was given to comparison of the avian material from that site, which contains more than twice the number of bird bones represented at the Mission Viejo site.

Of the nine avian families now recognized (Howard 1984) in the Round Mountain Silt, only four are represented in the Mission Viejo site. One species, Puffinus priscus, can be definitely cited from both areas. It is possible that one or both of the

other species of Puffinus described from Sharktooth Hill are also represented in the material assigned to the genus.

The solid bones suggest the presence of two species at both localities. It is anticipated that Warheit's study of this family, now under way at the University of California, Berkeley, will result in more definite identification.

A single anseriform femur points to the occurrence in the Mission Viejo deposits of a large diving form distinct from the Sharktooth Hill species, Presbychen abavus Wetmore 1930, but generically similar to a species I am in process of describing from the Kern County site (Howard ms).

Of particular interest are three bones of the family Alcidae assigned to the extinct genus Alcodes Howard, 1968). The family Alcidae is not represented at Sharktooth Hill. It is, however, well represented at the later Miocene locality in Laguna Hills, Orange County (LACM locality 1945), the type locality of Alcodes ulnulus.

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Figure 1. A-B Puffinus priscus, right humerus palmar and exteenal views; C Diomedea sp. proximalend of right ulna, internal view; D-E Puffinus ?n. sp. right humerus palmar and anconal views; F-G Puffinus priscus proximal end of right ulna, palmar and internal views. H Alcodes ulnulus holotype, ulna, external view; I-K Alcodes ?ulnulus: I ulna, external view, J humerus anconal view, K-L coracoid posterior and anterior views. All figures x1 except H and I x $1\frac{1}{2}$.

Fig. 1

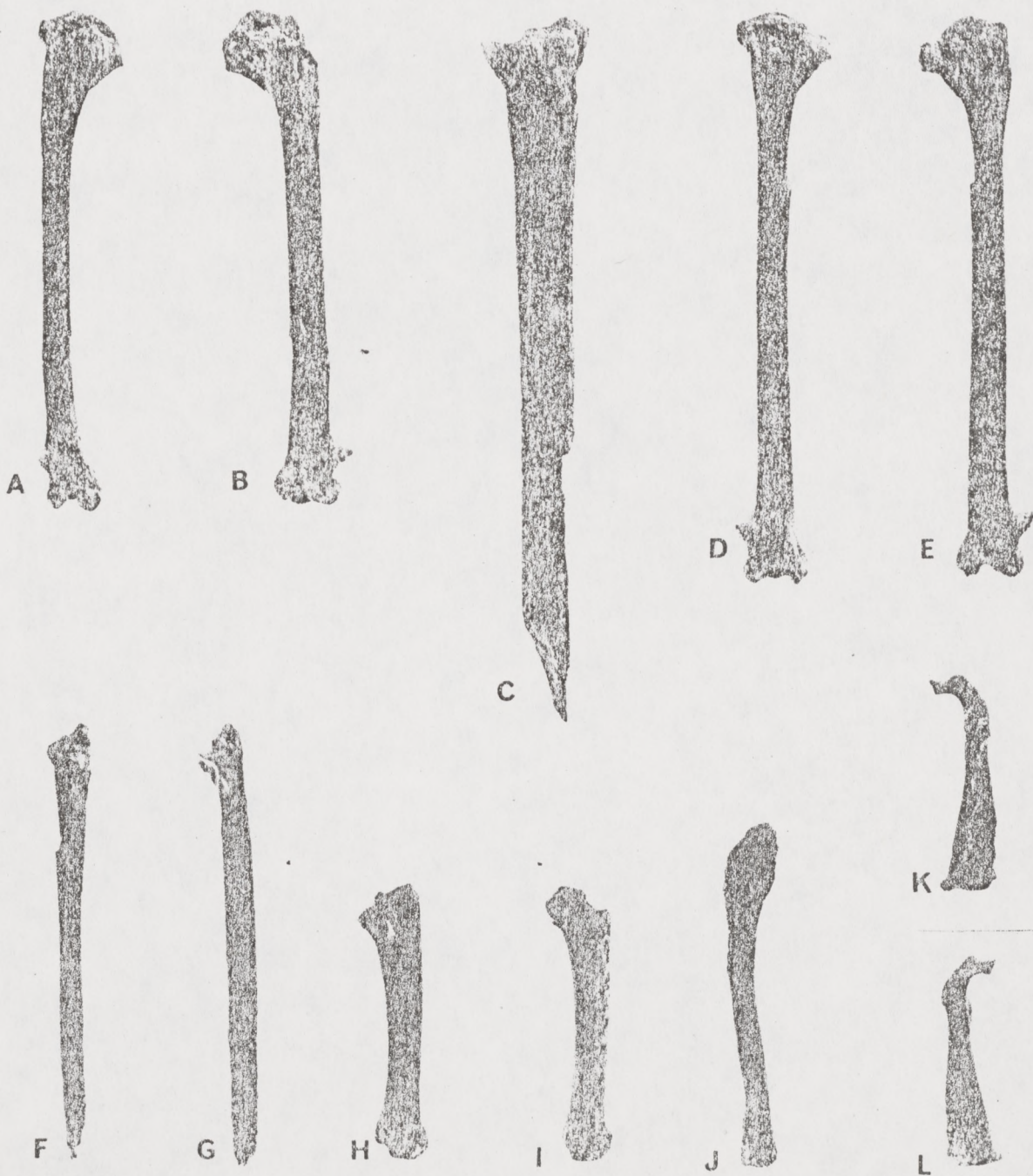


Table 1. Measurements of alcid ulnae (in millimeters)

	<u>Alcodes ulnulus</u>	<u>A. ?ulnulus</u>	<u>Aethia</u>	<u>Mancalla</u>
	holotype	LACM 120434	<u>pusilla</u> UCMVZ 60629	<u>milleri</u> minimum
Internal length	27.4	29.4	32.5	23.6
Breadth/depth of shaft	2.9/4.9	2.9/3.9	1.6/2.7	3.2/5.3

Photographs by

John De Leon

LACM Staff Photographer

Find copy of letter to.

Martin Ridge at
Huntington Library for

Harry Kealey. Send duplicate copy
from Committee files in Director's office.

ACKNOWLEDGMENTS

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My thanks go to the members of the Vertebrate Paleontology staff of LACM for the opportunity of studying this material, and for information supplied with regard to the methods of collecting.

In addition to Museum ^{present and former} staff members L.G. Barnes, R. M. McKenzie, B. J. Welton and R.E. Raschke, the following volunteers assisted in collecting the material: Joan ^{C.} Brown, Claire Heron, R. ^{Raymond} L. Price and Diana M. Weir.

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Revised
before submitted
to LACM
Contributions
for publication

MIDDLE MIOCENE BIRDS FROM THE FOOTHILLS OF THE
SANTA ANA MOUNTAINS, ORANGE COUNTY, CALIFORNIA^A

By

Hildegarde Howard¹

¹Chief Curator Emeritus, Natural History Museum of Los Angeles County

MIDDLE MIOCENE BIRDS FROM ~~MISSION VIEJO~~ *the Santa Ana Mountains foothills*

ORANGE COUNTY, CALIFORNIA

By

Hildegarde howard

MIDDLE MIOCENE BIRDS FROM THE FOOTHILLS OF
OF TEHE SANTA ANA MOUNTAINS
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MIDDLE MIOCENE BIRDS FROM THE FOOTHILLS OF THE
SANTA ANA MOUNTAINS, ORANGE COUNTY, CALIFORNIS

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MIDDLE MIOCENE BIRDS FROM THE FOOTHILLS OF THE
SANTA ANA MOUNTAINS, ORANGE COUNTY, CALIFORNIA

By

Hildegarde Howard

INTRODUCTION

From 1978 to 1983 the Natural History Museum of Los Angeles County collected fossils in Middle Miocene marine sediments exposed in the foot hills of the Santa Ana Mountains in the north part of Mission Viejo, Orange County, California (Raschke, 1984). The material was exposed during the grading of hills on both sides of Oso Creek during construction of an earth-fill dam, named later Upper Oso Dam. The subjects of the present study are the 54 bird bones, representing 34 individuals. These are from LACM localities 4545, 4546 and 4547, in descending order of stratification, in coarse sand deposits, which underlie shales and siltstones referred to the Late Miocene Puente and Monterey Formations in this area, and have been referred to the Topanga Formation (Morton, ^{et al 1973} Miller and Fife, 1973). (The Topanga Formation, in its type area in the Santa Monica Mountains, many miles to the north within the Los Angeles Basin, has been upgraded to the status of a group ^(Yarkes et al, 1979) and the name is probably no longer applicable in Orange County). The sediments are, ~~therefore,~~ ^{of the} older than those/bird-bearing Monterey Formation that have been previously reported (Howard 1966, 1968, 1976, 1978) ^{Orange County} from/Laguna Hills (Leisure World) and Laguna Niguel, several miles to the southwest, and in Orange County, and are roughly comparable in age to the Sharktooth Hill local fauna in the Middle Miocene Round Mountain Silt to the north, in Kern County. Fossil avian species have been described from the Sharktooth Hill Bonebed by Wetmore (1930), Miller (1961, and 1962), Howard (1966, 1984) and Warter (1976).

ABSTRACT. ~~The 54 poorly preserved avian bones from Middle Miocene deposits near Upper Oso Dam in Mission Viejo, Orange County, California, represent~~ ^{? milleri (Albatross)} Diomedea sp., Puffinus priscus, ^{p. (shearwaters)} Puffinus ?n. sp., Puffinus sps., ^{boobies and gannets} Sulidae (2 species) under study at University of California, Berkeley), Anatidae (undescribed ^{large duck} diving ~~goose~~) and Alcodes ?ulnulus. ^(flightless auk) Particular comparisons are made with ^{birds} specimens from ^{the Sharktooth Hill Bonebed} beds of the same age, at ^{Closest affinities} Sharktooth Hill, in Kern County, California. ^{The early flightless auk,} However, Alcodes is known only from the ^{younger strata in the} slightly later Monterey Formation deposits in Laguna Hills, Orange County.

A marine vertebrate assemblage of middle Miocene age has been recovered from the foothills of the Santa Ana Mountains in Orange County California. Several localities on both sides of Oso Creek produced fossils. Among these fossils,

These ^{comprise} ~~are~~ the oldest fossil avifauna yet described in the Orange County area, and the only ^{from} Middle Miocene age south of the outcrops of the ^{ones of} Sharktooth Hill Bonebed in Kern County.

METHODS AND MATERIALS

Acronyms used for institutions are:

CAS-California Academy of Sciences, San Francisco

LACM-Natural History Museum of Los Angeles County, Los Angeles

UCLA-University of California at Los Angeles, California

UCMP-University of California, Museum of Paleontology,
Berkeley, California

UCMVZ-University of California, ~~Berkeley~~, Museum of Vertebrate
Zoology, Berkeley, California

USNM- United States National Museum of Natural History,
Washington, D.C.

In addition to the fossil material in the LACM collections, referred material and casts of types from CAS, UCMP, UCLA and USNM have been available for this study. Modern skeletal material is *de* from the LACM collections, with the exception of specimens of Aethia from UCMVZ.

The locality number LACM 4464 is applied to material found as float from LACM localities 4545, 4546 and 4547, but of no precise provenience.

Classification follows that of the 1983 edition of the American Ornithologists' Union Checklist of North American Birds.

SYSTEMATICS

ORDER PROCELLARIIFORMES

Family Diomedidae -- Albatrosses

Genus Diomedea Linnaeus, 1758Diomedea ? milleri Howard, 1966

✱ MATERIAL. Associated proximal half of right ulna and distal end ^{and} shaft fragments of ^{radius} ~~radius~~, LACM 120439 from LACM locality 4547.

DISCUSSION. Albatross bones have been previously reported from several Miocene age sites in California, but only two species, both from the Sharktooth Hill Bonebed, have been described: Diomedea californica Miller, 1962 and D. milleri Howard, 1966. The holotype of D. californica is a tarsometatarsus, slightly larger than that of the modern albatross, D. albatrus, but not as large as that of D. exulans. D. milleri was of markedly smaller size.

The holotype of D. milleri is a proximal end of an ulna with a proximal breadth of 14.4 mm, as compared to 17.6 mm for that of the living D. nigripes (see Howard, 1966:4). The ulna, LACM 120439, ^{the} from Upper Oso Dam site measures 15.8 mm. The associated radius is also narrower of shaft than in D. nigripes. The area immediately distal to the ulnar cotylae, which contains the diagnostic characters of the species D. milleri, is crushed in LACM 120439. However, a clearly defined ridge on the palmar side of the shaft below this area suggests that there was a distinct angle between the palmar and internal surfaces of the shaft immediately below the internal cotyla as described for D. milleri. Although LACM 120439 appears to have a more prominent acromion and external cotyla than in the holotype of D. milleri, these areas are ^{slightly} eroded in the latter.

Family Procellariidae -- Shearwaters

Genus Puffinus Brisson, 1760

Puffinus priscus Miller, 1961

REFERRED MATERIAL. Left humerus, LACM 120415; associated right and left humeri and incomplete right ulna, LACM 120416; distal end of right humerus, LACM 120417; proximal fragment of left ulna, LACM 120424, all from locality LACM 4546. Proximal three fourths of right humerus, LACM 126159, from locality 4464.

TENTATIVELY REFERRED MATERIAL. Right and left distal ends of tibiotarsi, LACM 120425 (right) and 120426 (left); right tarsometatarsus lacking proximal end, LACM 120419, all from locality 4546.

DISCUSSION. The humeri agree in general conformation, size and flatness of shaft with the holotype distal end of this element from the Sharktooth Hill Bonebed and/or with addition unpublished specimens (three of which--LACM 18140, LACM 44556 and LACM 126219-- are complete) from the same locality, now referred to Puffinus priscus. Measurements of Oso Dam humeri are: length 79.3-81.2 mm, breadth distal condyles 7.4-7.7 mm, distance from distal surface of condyles to proximal surface of ectepicondylar prominence 9.5-9.9 mm. The same measurements in Sharktooth Hill humeri assigned to P. priscus are: length 80.3-82.5 mm, breadth distal condyles 7.1-7.7 mm (holotype 7.5 mm), and distance from distal condyles to proximal surface of ectepicondylar prominence 8.9-10.0 mm (holotype 9.5 mm).

The two ulnae, one of which is associated with humeri LACM 120416, have a high, pointed olecranon (possibly exaggerated by crushing in this area) and long, pointed and upturned external cotyla. These characters are suggestive of those of modern P. opisthomelas, though to an exaggerated degree.

6
The tarsometatarsus, which measures 6.1 mm in distal breadth,
is tentatively assigned ^{to P. priscus} on the basis of ^{favorable} comparison with ~~tarsometatarsi~~
from Sharktooth Hill. Of the three Puffinus tarsometatarsi now
available from ^{the latter} ~~that Kern County~~ locality, one incomplete distal
half (LACM 104058), which agrees in size with LACM 120419 from ^{orange} ~~Mission~~
^{county} Vieja, is slightly smaller than the other two and ^I ~~is~~ believed ^{is}
~~to be~~ assignable to P. priscus.

The tibiotarsi resemble the only distal end of this element ^{that has}
^{been} found at Sharktooth Hill, LACM 1222994, ^{a specimen} which is tentatively
referred to P. priscus on the basis of size relative to the
tarsometatarsi ^{its} above ^{that of} noted.

47

Puffinus sp., possibly undescribed

REFERRED MATERIAL. Associated complete, but poorly preserved, right humerus, crushed proximal end of ulna and proximal and distal fragments ~~fragments~~ of radius, LACM 120422, from locality LACM 4546. Collected 23 April, 1980 by L. ^GP. Barnes.

DESCRIPTION. The humerus is notably distinguishable from the holotype of P. priscus Miller, 1961 (UCMP 58185), but less so from the holotype of P. mitchelli Miller, 1961 (UCMP 58184) (casts^S of which are at hand) in having a more rounded, less flattened shaft. In length, it is intermediate between specimens from Sharktooth Hill referred to these species; LACM 120422, 90.4 mm; Sharktooth Hill P. priscus specimens 80.2-82.5 mm, one measureable specimen of P. mitchelli (LACM 17500) 98.1 mm. The ulna is severely crushed and measures only 7.0 mm across the cotylae. The olecranon is crushed to a point.

DISCUSSION. Poor preservation of the Upper Oso Dam humerus makes difficult any detailed comparison with P. inceptor Wetmore, 1930. A cast of the holotype distal end of humerus of P. inceptor (CAS 5223) is available. The Oso Dam specimen is broken through the internal trochlea, but appears to lack the notable internal thrust of the distal end which is characteristic of P. inceptor, and is reflected in the measurements given by Wetmore (1930:87): breadth of shaft 5.9 mm, greatest distal breadth 12.2 mm. In the Oso Dam humerus, the shaft breadth is 6.3 mm, distal breadth 11.2 mm.

Other Miocene members of the genus Puffinus recorded from California include P. diatomicus Miller, 1925 from the Late Miocene Sisquoc Formation in Santa Barbara County in which the humerus is included in the holotype and referred skeletal impressions. Miller

\$ 8

recorded the length of these humeri as 80-84 mm (considerably smaller than LACM 120422). The humerus is the holotype of the two Late Miocene Orange County species, P. calhouni Howard, 1968 and P. barnesi Howard, 1978. Both are smaller and have a more compressed shaft than in LACM 120422. Compared with the holotype distal end of the Early Miocene P. micraulax Brodkorb, 1963 from Florida, LACM 120422 is broader. The holotype distal end of humerus of P. conradi Marsh, 1970, from the Middle Miocene Calvert Formation of Maryland, is broader and has a heavier shaft.

The poor condition of LACM 120422 precludes naming a species with this material as holotype. Should more specimens assignable to this shearwater become available, studies should also be made of the French Middle Miocene species, P. aquitanicus (Milne-Edwards, 1874), P. antiquus (Milne-Edwards, 1874, and P. arvernensis Milne-Edwards, 1871, redescribed by Shufeldt, 1896. In fact, Olson (1985:211) has noted the need for a world-wide revision of fossils assigned to the genus Puffinus.

Puffinus spp.

REFERRED MATERIAL. Complete right ulna, LACM 120420; distal 3/4 left ulna, LACM 124360; proximal and distal ends of right ulna LACM 120421; fragment of proximal end of left ulna, LACM 126155; associated fragments of distal end of ulna and proximal end of radius and carpometacarpus, LACM 126156; complete radius, LACM 120423; right carpometacarpus, LACM 120419; associated fragments of distal end of left ulna and tarsometatarsal shaft, LACM 126157; all from locality LACM 4546. Distal fragment of radius, LACM 20412; incomplete right humerus, LACM 126160 from Locality LACM 4464.

DISCUSSION. Size alone suggests that at least two species are represented by this material. Most of the specimens are of the small size suggestive of P. priscus. One poorly preserved humerus (LACM 126160) and one ulna (LACM 120420) are, however, notably larger. The humerus has been partly restored, but appears to have a more flattened shaft toward the distal half of the bone than do humeri of P. mitchelli from Sharktooth Hill. The length of this poorly preserved humerus, from proximal edge of brachial impression to head, is 83.2 mm. The same measurement of a Sharktooth Hill humerus, LACM 17500, referred to P. mitchelli, is 86.6 mm. The ulna, LACM 120420, has a length of 95.7 mm. By contrast, the longest ulna known from the Sharktooth Hill Bonebed (LACM 124359) measures only 88.2 mm. Both are markedly larger than the incomplete Upper Oso Dam ulna (LACM 120416) which is associated with the humerus assigned herein to P. priscus.

10
ORDER PELECANIFORMES *Sharpe, 1891*

(Reichenbach, 1849)
Family Sulidae -- Boobies and Gannets

MATERIAL Sulidae, spp.

~~SPECIMENS~~
Referred material. *all* From locality 4546, associated right and left humeri, ulnae, and badly crushed radius, LACM 120433; associated left coracoid and proximal fragment of shaft of left humerus, LACM 120428; right tarsometatarsus lacking part of proximal end, LACM 120432; proximal end of radius, LACM 120429; proximal end of humerus, LACM 120430; distal end of humerus, LACM 120431; skull fragment, LACM 120427. *all* From locality LACM 4547, associated incomplete radius and ulna, LACM 120439; humerus LACM 123910; associated seven incomplete and poorly preserved bones lying together in matrix with the following elements represented: incomplete mandible, proximal end of right humerus, three fragments of left humerus, fragment of left ulna, distal end of right radius, proximal end of left radius overlying left carpometacarpus, LACM 126161.

Discussion. This material will be included in ~~Kenneth~~ Warheit's study of the family Sulidae. In my brief examination of the material from *Upper Oso Dam*, ~~Mission Viejo~~ I noted two humeri (LACM 120433, and LACM 120431) which exceed in measurements specimens of Morus vagabundus Wetmore, 1930, the one *by* sulid species described from *the* Sharktooth Hill. Distal breadth of *the* holotype of M. vagabundus *is* 18.3 mm, *the* same measurement in LACM 120431, *is* 21.0 mm; length of referred humerus of M. vagabundus, 170 mm (Howard 1966:6), length of LACM 120433, 183 mm. On the other hand, *the Upper Oso Dam* ~~Mission Viejo~~ specimens LACM 120428, 120432 and 120438, though difficult to measure exactly, suggest a smaller ~~form~~ *species*.

That more than one species of sulid occurred *at* Sharktooth Hill *was* noted by Miller (1961:401), who recorded a proximal

Bonebed

fragment of ulna of larger size than the one referred to M.
vagabundus by Wetmore (1930). Also, Howard (1966:7) ~~recorded~~ ~~described~~
two tarsometatarsi which differ in qualitative characters as well
as ⁱⁿ size.

ORDER ANSERIFORMES

Family Anatidae -- Ducks, ~~Geese~~ and Swans

Subfamily Anatinae -- Ducks

Tribe Mergini -- Divers

~~REFERRED SPECIMEN~~. Distal end of left femur, LACM 125994, from locality LACM 4546, collected by Museum field party, 1981.

DESCRIPTION. The fibular condyle is thrust laterally, and there is deep angular depression above the condyles, posteriorly, as in diving ducks such as those of the genera Somateria, Mergus and Melanitta, but the specimen is markedly larger than in living species of these genera. The breadth of the distal end is 20.7 mm.

DISCUSSION. This femur represents a large diving anatid, goose-like in size, and in general conformation suggestive of undescribed specimens of femora from the Sharktooth Hill Bonebed. It is, however, more slender, and the muscle scar on the internal side of the posterior face is more proximally placed. Anteriorly the intercotylar area appears to be more deeply excavated, but allowance must be made for the poor preservation of the specimen.

The femora and other related elements of the skeleton from the Sharktooth Hill Bonebed are still under study. It is anticipated that a new species, and probably a new genus, will be proposed. The single femur from Upper Oso Dam indicates the presence of a large diving anatid in ^{the} Orange County ^{area} at the same time as the existence of such a bird--probably congeneric, but specifically distinct--in the Kern County area.

ORDER CHARADRIIFORMES *Huxley, 1867*
Vigors, 1825
 Family Alcidae -- Auks, et al

Genus Alcodes Howard, 1968

Alcodes ?ulnulus Howard, 1968

SPECIMENS
Referred Material. (From locality LACM 4546, left ulna,
 LACM 120434, from locality LACM 4545, left humerus, LACM 120414;
 LACM
 from locality 4547, right coracoid, LACM 121010.

Description. The holotype of Alcodes ulnulus is a complete left ulna (LACM 18277), *and a* with distal end of *a* right ulna (LACM 18270) and *the* proximal end of right carpometacarpus (LACM 18278) *have been* referred. An incomplete proximal portion of right ulna (LACM 18280), ten percent larger than the holotype, was tentatively referred. *by me to the same species.*

The *from Upper Oso Dam* Oso Dam ulna *it by having a* is not as well preserved as the holotype, but resembles *for such* it in the relatively heavy shaft in a short bone. It is, however, slightly longer, and relatively narrower than the holotype. In contrast, the ulna from a *Recent* modern specimen of *the* Least Auklet, Aethiapusilla (UCMVZ 60629), is longer and narrower, and that of the *Pliocene* flightless auklike swimmer, ~~of the Pliocene,~~ Mancalla milleri Howard, 1966, is shorter and broader. Although *had evolved in the direction of* Alcodes suggests a trend toward flightlessness, it is clearly not as far advanced as *in* Mancalla.

Table 1. Measurements of Ulnae (in millimeters)

	<u>Alcodes ulnulus</u> holotype	<u>A. ?ulnulus</u> LACM 120434	<u>Aethia</u> <u>pusilla</u> UCMVZ 60629	<u>Mancalla</u> <u>milleri</u> minimum
Internal length	27.4	29.4	32.5	23.6
Breadth/depth of shaft	2.9/4.9	2.9/3.9	1.6/2.7	3.2/5.3

on separate sheet of paper
 The Humerus 120414, though incomplete, *resembles* is suggestive of the paratype specimen of *the Pliocene* Mancalla milleri (LACM 2813) in *Howard, 1970* compression of the distal end and *its* height of *the* ectepicondylar prominence. The

ORDER CHARADRIIFORMES

Family Alcidae -- Auks et al

Genus Alcodes Howard, 1968Alcodes ?ulnulus Howard, 1968

MATERIAL. Left ulna, LACM 120434 from locality LACM 4546; left humerus, LACM 120414, from locality LACM 4545; right coracoid, LACM 121010 from locality LACM 4547.

DESCRIPTION. The holotype of Alcodes ulnulus is a complete left ulna (LACM 18277), ^{with} ~~xxxx~~ a distal end of a right ulna (LACM 18279) and the proximal end of right carpometacarpus (LACM 18278) (Howard, 1968) ~~xxxxxx~~ referred to the species. An incomplete proximal portion of right ulna (LACM 18280, ten percent larger than the holotype, was tentatively referred in the same publication.

The ulna from Upper Oso Dam is not as well preserved as the holotype, but resembles it by having a relatively heavy shaft for such a short bone. It is, however, slightly longer, and relatively narrower than the holotype. In contrast, the ulna from a Recent specimen of the Least Auklet, Aethia pusilla (UCMVZ 60629), is longer and narrower, and that of the Pliocene flightless auk-like swimmer, Mancalla milleri Howard, 1966, is shorter and broader. Although Alcodes had evolved in the direction of flightlessness, it is clearly not as far advanced as Mancalla.

The humerus, LACM 120414, though incomplete, resembles the paratype specimen of the Pliocene Mancalla milleri Howard, 1970 (LACM 2813) in the compression of the distal end and the height of its ectepicondylar prominence. The deltoid crest, however, is not as extensive as in M. milleri, and the shaft is narrower throughout. Other distinctive characters, peculiar to the Upper

Oso Dam specimen are: proximally the pectoral attachment and external tuberosity are distinctly external to the capital shaft ridge, separated from the ridge by a depression, and the ridge is more angular; the depression below the head, internal to the capital shaft ridge extends distally to the line of the distal edge of the incomplete bicipital crest. The bone is too poorly preserved for accurate measurements.

The coracoid from Upper Oso Dam resembles that of M. milleri in its straight shaft and narrow sternal facet. It is, however, shorter than the smallest known coracoid of M. milleri, and is further distinguished as follows: triosseal canal angular at the anterior edge, with tip of furcular facet projecting farther anteriorly; anterior surface of shaft evenly rounded throughout its length, lacking the flattening and internal projection, distally, characteristic of M. milleri. Greatest length 34.3 mm; M. milleri minimum (Howard, 1970:8), 38.5 mm.

DISCUSSION. These three bones represent the only alcid material collected from the Upper Oso Dam localities. No species of the family Alcidae has ever been found in the Sharktooth Hill Bonebed, but at least five genera are represented among the 27 alcid bones recorded (Howard, 1968) from the ^{lower part of the} Monterey Formation (Leisure World site, LACM locality 1945), the type locality of Alcodes ulnulus. The genus had not been previously recorded elsewhere.

As originally described, Alcodes was placed, somewhat questionably, in the subfamily Mancallinae because of its apparent adaptations to flightlessness. More recent surveys of the flightless alcids has led Olson (1985) and Chandler (in lit.) to question the need to recognize a subfamily distinction (Mancallinae) even for Mancalla.

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Photographs

- 3 views 1 Puffin 2 n sp humer 120422 90 mm long 3 views
 3 views 2 P. prurius assoc. humer & ulna 120416 anconal + ext, palm
 120416 anconal + ext humer
 120416

1 1. femur of Viregini 125994 protein

7 4 Alcedo ulna 120434 (with holotype ulna 18255 from 1945)
 2 (type syst. ulna extens.
 14 3 (an. aut. part
 views 2 (humerus palma
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coracoid 121010

humer 120414

Dr
 Mr
 J. A.

Ref.

- 1 ulna 126420 complete hum
 120420 small
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 3 120421
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 obscure less
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90 Fossil marine birds have been discovered in a marine vertebrate assemblage in ~~the~~ Middle Miocene rocks that underlie the Monterey Formation, the source of previously described Late Miocene birds in Orange County.

CONCLUSIONS

The poor preservation of the avian material from the Oso Dam site in Mission Viejo has made difficult the specific assignment of the 54 avian bones represented. They are, however, ~~referred~~ ^{identifiable} as follows (number of bones in parentheses):

Family Diomedeidae -- Albatrosses

Diomedea ^{? milleri Howard, 1966} sp. (2)

Family Procellariidae -- Shearwaters et al

Puffinus priscus Miller, 1961 (10)

Puffinus ? n. sp. (3)

Puffinus sps. (13)

Family Sulidae -- Boobies and Gannets

Sulidae, two sps. (22)

Family Anatidae -- Water Fowl

Tribe Mergini (1) ^{genus and species undetermined}

Family Alcidae -- Auks et al

Alcodes ? ulnulus Howard, 1968 (3)

The age of the ~~Mission Viejo~~ ^{sandstone} deposits is considered ^{bearing these fossils at Upper Oso Dam} similar ^{to be} approximately to that of ^{Sharktooth Hill Borebed in the upper part of the} the ~~Round Mountain Silt~~ at ~~Sharktooth Hill~~, in Kern County, California. Therefore special attention was given to comparison of the avian material from that site, which contains more than twice the number of bird bones represented at the ^{Upper Oso Dam} ~~Mission Viejo~~ site.

Of the nine avian families now recognized (Howard, 1984) in the ~~Round Mountain Silt~~ ^{Sharktooth Hill local fauna}, only four are represented ^{at the Upper Oso Dam} in the Mission

~~Viejo~~ site. One species, ^{the shearwater} Puffinus priscus, ~~can be definitely~~ ^{occurs at both localities} cited from both areas. It is possible that one or both of the

~~The albatross is questionably assigned to D. milleri from Sharktooth Hill~~
The albatross, Diomedea sp., is near the size of D. milleri from the Sharktooth Hill Borebed, but appears to be morphologically different.

other species of Puffinus described from Sharktooth Hill are also represented in the material assigned to the genus. ^{from Upper Oso Dam}

The solid bones suggest the presence of two species at ^{the Orange County locality as in the Sharktooth Hill Bonebed} both localities. It is anticipated that Warheit's study of this family, now under way at the University of California, Berkeley, will result in more definite identification.

A single anseriform femur ^{documents} points to the occurrence in the ^{at Upper Oso} Mission Viejo deposits ^{Dam} of a large diving ^{goose} form distinct from the ^{previously} named Sharktooth Hill species, Presbychen abavus Wetmore 1930, but ^{at least} congenerically similar ^{with} to a species I am in process of describing ^{Same Bonebed in Kern County site (Howard, ms.) in preparation} from the Kern County site (Howard, ms.) ^{a species of}

Of particular interest are three bones of ^{Primitive, flightless auk} the family Alcidae assigned to the ^{No specimens representing} extinct genus Alcodes Howard, 1968). ^{have even been found in the Bonebed} The family Alcidae ^{is not represented at Sharktooth Hill}. It is, however, ^{in younger, late Monterey formation} well represented ^{at the later Miocene locality in Laguna Hills, Orange County (LACM locality 1945)}, the type locality of Alcodes ulnulus. ^{oldest known in Orange Co.}

The fossil bird assemblage from Upper Oso Dam is the ^{and the only Middle Miocene} one yet described from California aside from that in the Sharktooth Hill Bonebed approximately 200 miles to the north. This is also the southernmost documented occurrence of ~~faunal~~ ^{marine} Middle Miocene birds in western North America. The Orange County site is on the opposite side of the San Andreas fault from the Sharktooth Hill Bonebed, and, accounting for prior lateral displacement, might have originally been considerably farther south in Middle Miocene time. This may explain why flightless auks have never been found in the Kern County fossil record but are relatively common in Orange County.

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Fig. 1

new

Table 2

have

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